NATIONAL BUREAU OF STANDARDS REPORT

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on the

Mechanisms of Fire Ignition and Extinguishment

by

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U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

MECHANISMS OF FIRE IGNITION AND EXTINGUISHMENT

1. SUMMARY

Work has been continued in the evaluation of dry powders by comparison of the efficiencies of a number of them on 1-in., 6-in., and 10-in. diameter n-heptane fires. Construction of a mass spectrometer has been started for the purpose of sampling ions from flames. Exploratory work has been completed on the characteristics of magnesium fires.

2. EXTINGUISHMENT BY POWDERS

The relative efficiencies of a number of powders has been compared on 1-in. and 6-in. diameter n-heptane fires and some preliminary results have been obtained on 10-in. diameter fires. These results are included in a report which is being put into final form for publication. Some work has been done toward extending the study to 3-ft diameter fires.

3. THERMAL REACTIONS

The recently completed literature survey of thermal processes in flames indicated the importance of ionic reactions. It is probable that extinguishment results from interference with these rather than with other flame processes. In order to identify the ions present in normal and inhibited flames and get a semi-quantitative estimate of their relative abundances, it was decided to sample ions directly from flames into the analyzer tube of a mass spectrometer. A simple mass spectrometer was almost completely constructed by Mr. Robert Mills, a summer trainee, before he returned to school. No further work has been done.

4. EXTINGUISHMENT OF MAGNESIUM FIRES

Exploratory work on the characteristics of small magnesium fires has been completed. Additional work has been done on methods of extinguishment of such fires. The results of the observations will be contained in two reports which are now in rough draft form.

INVESTIGATIONS OF FLAME IONIZATION AND RELATED PHENOMENA

1. SUMMARY

Work has been continued in the evaluation of dry powders by comparison of the efficiencies of a number of them on 1-in., 6-in., and 10-in. diameter burner tubes. Construction of a mica spectrometer has been started for the purpose of sampling ions from flames. Exploratory work has been completed on the characteristics of negative flames.

2. MEASUREMENT BY POWDERS

The relative efficiencies of a number of powders have been compared on 1-in. and 6-in. diameter n-hepteno flat zone preliminary results have been obtained on 10-in. diameter flames. These results are included in a report which is being put into final form for publication. Some work has been done toward extending the study to 3-ft diameter flames.

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The recently completed literature survey of thermal processes in flames indicated the importance of ionic reactions. It is possible that extinguishment results from interference with these rather than with other flame processes. In order to identify the ions present in normal and inhibited flames and get a semi-quantitative estimate of their relative abundance, it was decided to sample ions directly from flames into the analyzer tube of a mass spectrometer. A simple mass spectrometer was almost completely constructed by Mr. Robert Ellis, a summer trainee, before he returned to school. No further work has been done.

4. MEASUREMENT OF NEGATIVE FLAME

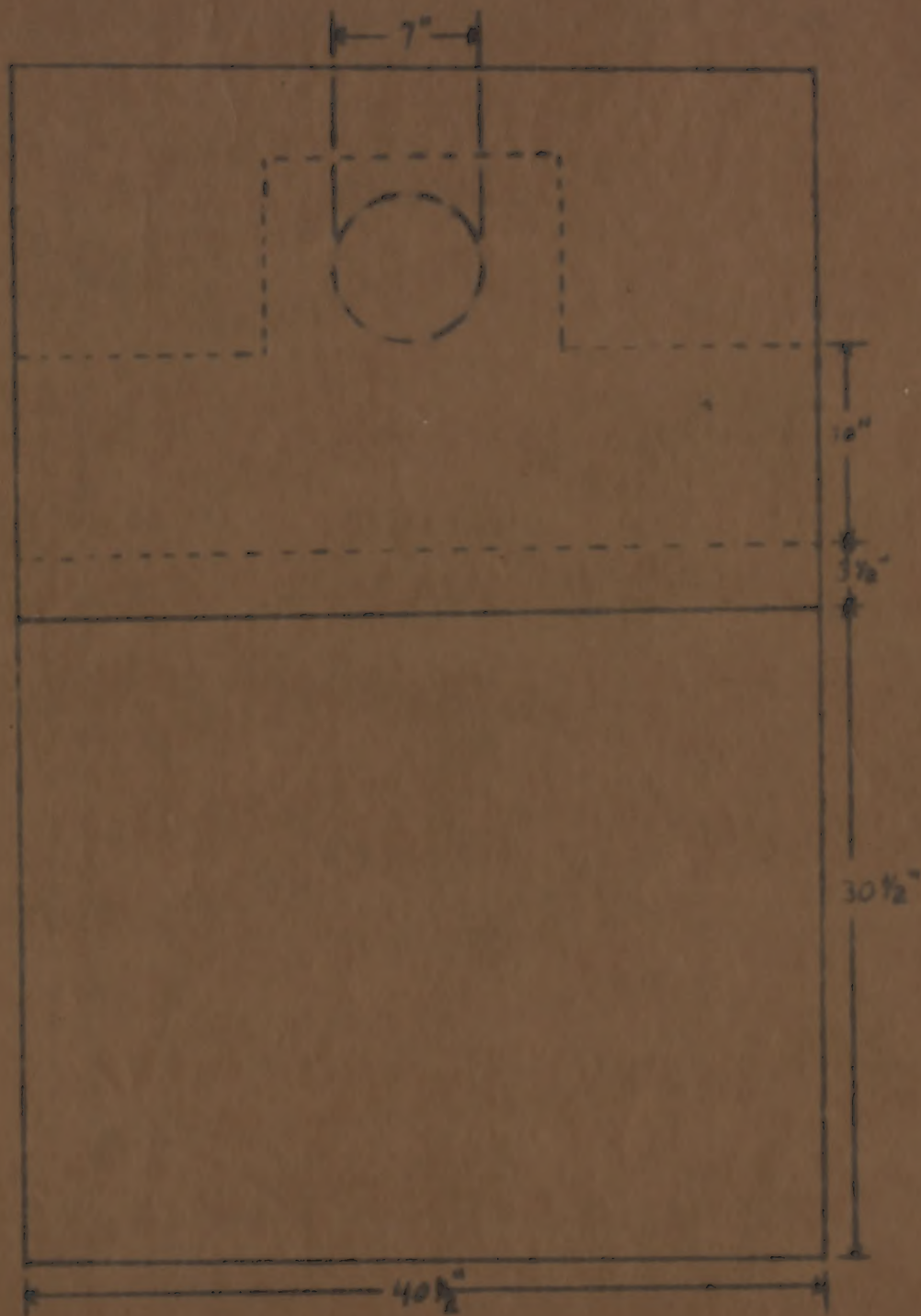
Exploratory work on the characteristics of small negative flames has been completed. Additional work has been done on methods of extinguishment of such flames. The results of the observations will be described in two reports which are now in rough draft form.

of 100 ft/min would rotate the anemometer steadily. It is concluded, therefore, that the air flow rate in the access opening was less than 100 ft/min with the window fully open. Smoke tests made with the window fully open indicated some back flow from the hood to the room with the blower running.

5. Discussion

If the air circulation rate with the window fully open was about equal to that measured with it raised 4 5/8 in. from the bottom, the average air velocity for the entire opening would be about 80 ft/min. Thus, it is probable that the actual air flow rate was between 80 and 100 ft/min with the window fully open and with a static pressure of 1/4 in. W.G. on the discharge of the blower.

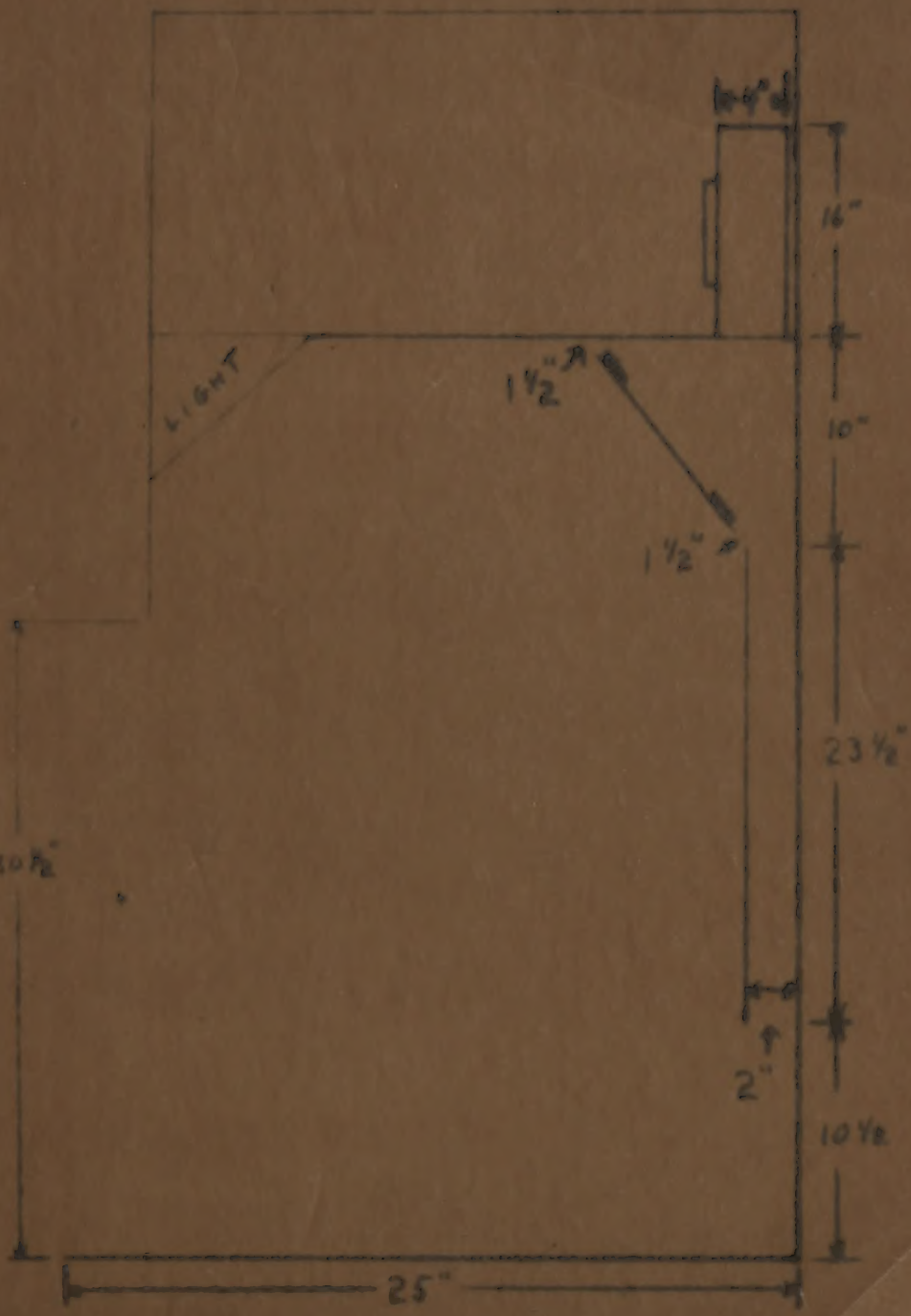
An operator standing in front of the fume hood window and working with the window wide open, as would be required for satisfactory access, might create some blocking of the air inlet and thus increase the average air velocity somewhat in the remaining free area. However, this blocking effect would probably be small because the operator would normally stand a few inches away from the plane of the inlet opening.

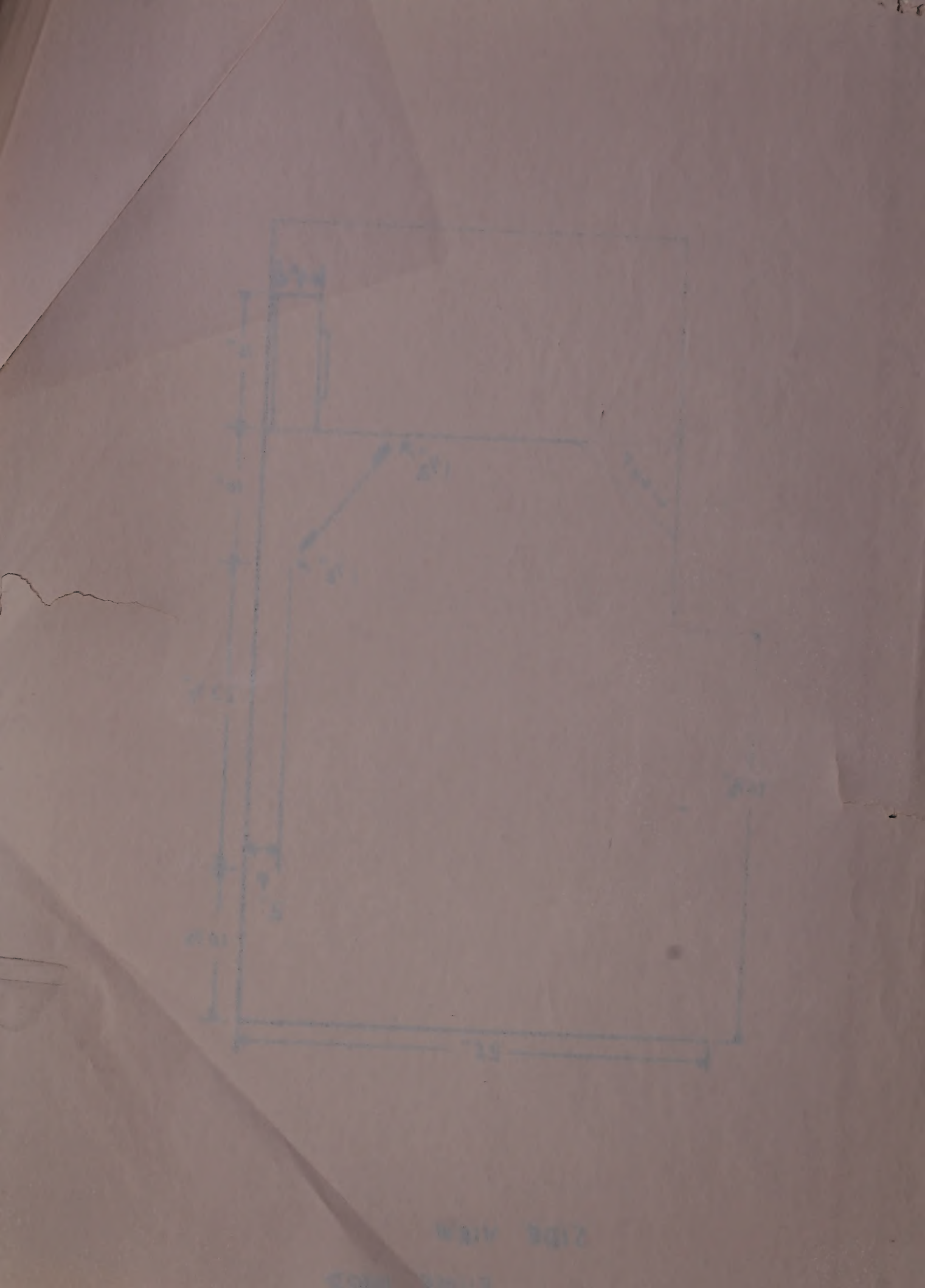


OPEN

FRONT VIEW

FUME HOOD



SIDE VIEW

FUME HOOD